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AUTHORITY
30 Sep 1974, DoDD 5200.10; USNSWC ltr, 18 Nov 1975

Functioning Test of P.D. Rocket Fuze T-2025

PART A

SYNOPSIS

1. a. The Magnavox Company, Fort Wayne, Indiana, is currently working on the development of the T-2025 nose fuze for use with the 2"75 High Explosive, Folding Fin Aircraft Rocket.

b. Previous tests conducted on this fuze at other activities reported that this fuze has functioned on 0"032 and 0"500 thick aluminum targets at striking velocities of approximately 980 ft. per sec. The fuze functioning times obtained were approximately 500 to 600 microseconds.

2. The object of this test was to determine the impact sensitivity and functioning delay of the T-2025 fuze, rocket fired at higher velocities against thin aluminum targets.

3. The following conclusions are based upon the limited number of rounds fired during this test.

a. The T-2025 fuzes tested were not sensitive enough to function on less than 1/4" thick 24ST aluminum targets set at 0° obliquity at velocities of 2000 ft/sec.

b. One of three rounds fired at 0"250 thick 24ST aluminum targets set at 0° obliquity detonated high order. The delay was less than 6 inches. Average rocket striking velocities were 1800 ft/sec.

c. Two of 4 rounds fired at 0"500 thick 24ST aluminum plate set 0° obliquity detonated high order; one with a delay of less than 6 inches and the other less than 2 ft. Average rocket striking velocities were 1800 ft/sec.

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PART B

INTRODUCTION

1. AUTHORITY:

This test was conducted in accordance with enclosure (1) of reference (b) as authorized by reference (a).

2. REFERENCES:

a. NAVPROV Telcon OPG:RLH:ach L1-2 of 9 April 1952
b. OCO ltr: ORDTA 0.0 471.82/1027 (c) 26 March 1952

3. BACKGROUND:

a. The Magnavox Company, Fort Wayne, Indiana, is currently working on the development of the T-2025 nose fuze for use with the 2.75 High Explosive, Folding Fin Aircraft Rocket.

b. Previous tests conducted on this fuze at other activities reported that this fuze has functioned on 0.032 and 0.500 thick aluminum targets at striking velocities of approximately 980 ft. per sec. The fuze functioning times obtained at one activity were approximately 500 to 600 microseconds.

4. OBJECT OF TEST:

The object of this test was to determine the sensitivity and functioning delay of the T-2025 Fuze, rocket fired at high velocities, after impact with light aluminum armor.

5. PERIOD OF TEST:

a.	Date Project Letter	15 Apr 1952
b.	Date Necessary Material Received	5 Apr 1952
c.	Date Commenced Test	16 Apr 1952
d.	Test Completed	18 Apr 1952

6. REPRESENTATIVES PRESENT:

Mr. A. Nunes-Vais	Picatinny Arsenal
Mr. Chester Piper	Magnavox Corp.
Mr. J. C. Koonz	Magnavox Corp.
Mr. James Kistle	Office of Chief of Ordnance

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. The T-2025 is a point detonating rocket fuze being developed for use with the 2"75 High Explosive, Folding Fin Aircraft Rocket. It is an electric type fuze having its electric power supplied by a small built-in generator. Figure 1 is a drawing of the fuze. The generator consists of a coil and a permanent magnet plunger held under spring tension at the entrance of the coil. The spring loaded plunger is triggered on target impact by a steel ball, which breaks the plunger at its restricted section allowing the plunger to be driven into the coil. When the magnetic plunger is driven into the coil an electromotive force of short duration is induced. This electromotive force reaches a peak of 100 volts which fires the electric primer connected in series with it.

b. The fuze safety features and arming mechanism were modified from that shown in Figure 1 to that shown in Figure 2 for these tests. This modification allowed the fuze to be armed prior to firing by withdrawing the arming wire. This eliminated the possibility of fuze arming failures occurring due to vibrations developed during passage of the rocket through the launcher rails.

c. Figure 3 is a photograph of the experimental rocket before and after assembly, as used in this test.

8. DESCRIPTION OF TEST EQUIPMENT:

a. Rocket Motors	5"0 Rocket Motor Mk 2 Mod 3
	5"0 Rocket Motor Model 38 (White Whizzer)
b. Rocket Adapters	5"0 to 2"75 head-to-motor adapter (steel) PX-8-539A
c. Launcher	NPG 1050 ft.
d. Cameras	One Bowen One 16mm High Speed Eastman
e. Velocity Recording Instruments	Oscillograph and Counter-Chronograph

9. PROCEDURE:

Three rounds with a black powder, smoke puff indicator were fired prior to the firing of full explosive loaded rounds. These were to determine whether launcher vibrations would cause the fuze to function while being projected down the track. They were fired as a precautionary measure, taken for the prevention of damage to the launcher.

The first two rounds fired had one 5" HVAR motor as a booster and a 5"0 "White Whizzer" Model 38 as the head motor. The head motor was ignited after 200 ft. of travel. Maximum striking velocity obtained by this test procedure was 2075 ft./sec. A study of the film record indicated that the head motors were not completely burnt out at the target. Therefore the booster motors on the following rounds were eliminated.

The Bowen Camera covered the target and approximately 500 ft. of rocket flight. The 16mm Eastman Camera also recorded the target area.

10. RESULTS AND DISCUSSION:

a. Details of test results are found in Table I.

b. Summarized test results are as follows:

No. of Rds.	Target-24ST Aluminum	Obliquity	Striking Velocity (ft/sec.)	Functioning High Order	Functioning Dud
1	0".032	0°	2075	--	1
1	0".064	0°	2169	--	1
1	0".064	45°	1976	--	1
1	0".125	0°	Est. 2200	--	1
3	0".250	0°	Approx. Av. 1800	1	2
4	0".50	0°	Approx. Av. 1800	2*	2

* One round token loaded
One round High Explosive Loaded

c. Delays in explosive functioning of the High Explosive Loaded rounds were estimated to be less than 6 inches. Figures 7 and 11 show target penetration and High Order explosive action of rounds 5 and 9 respectively. Figure 12 shows the results of the impact of round 9 on 1/2" 24ST aluminum. Fragmentation marks of High Order detonation can be seen on the face of the target substantiating

the estimated delay of this round to be less than 6 inches. Figures 5, 6, 8, 9, 10, 13, and 14 are photographic records of target impacts for rounds 2, 3, 6, 7, 8, 10, and 11 which were all duds. The explosive actions seen in these records were not caused by rocket head detonation but includes a plate flash and burning of aluminum dust resulting from the heat generated during penetration.

d. One High Order detonation occurred during the firing of the three token loaded rounds. Figure 4 shows target impact and detonation action of this round. The delay of this round could not be accurately measured but was estimated to be not greater than 24 inches.

e. The following analysis of the above results are based entirely on the assumption that a sufficient electric charge is consistently generated by the T-2025 fuze during normal operating procedure.

(1) Four rounds were fired at 24ST aluminum targets less than 1/4" thick and were all duds. This may indicate that the energy imparted to the steel ball on target impact was not sufficient to rupture the steel plunger at its restricted section.

(2) Four of the seven rounds fired at 24ST aluminum targets 1/4" thick and 1/2" thick were duds. These duds may be attributed to the disarrangement of fuze components limiting the freedom of plunger motion, resulting from the added severeness of target impact.

(3) Figure 15 shows the recovered, unexploded 2.75 rocket head, with the T-2025 fuze fired as round 10. It had penetrated one-half inch thick 24ST aluminum plate set at 0° obliquity at a striking velocity estimated as 1900 ft/sec. It appeared that the flat steel nose section of the fuze housing had been driven back into the cylindrical void in which the steel ball bearing and plunger head are located. Army representatives present advised that drop tests of other T-2025 fuzes had produced similar damage. Fuzes subjected to the drop tests had the sleeve assembly and coil bushing assembly (shown in Figure 1) deformed and disarranged, limiting the motion of the magnetic plunger. This prevented the generator from functioning. No facilities were available for breaking down the recovered dud at this activity. Therefore no examination of the internal damage could be made. However, since the external damage was similar to that on the fuzes subjected to drop tests it may be assumed that the internal damage was also similar.

PART D

CONCLUSIONS

11. The following conclusions are based upon the limited number of rounds fired during this test.

a. The T-2025 fuzes tested were not sensitive enough to function on less than 1/4" thick 24ST aluminum targets set at 0° obliquity, at striking velocities of 2000 ft/sec.

b. One of 3 rounds, fired at 0".250 inch thick 24ST aluminum targets set at 0° obliquity, detonated high order. The delay was less than 6 inches. Average rocket striking velocities were 1800 ft/sec.

c. Two of 4 rounds fired at 0".5 thick 24ST aluminum plate set at 0° obliquity detonated high order. One with a delay of less than 6 inches and the other less than 2 ft. Average rocket striking velocities were 1800 ft/sec.

Functioning Test of P.D. Rocket Fuze T-2025

The tests upon which this report is based were conducted by:
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Terminal Ballistics Department

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By direction

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NPG REPORT NO. 1023

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

First Partial Report

on

Army R&D Aircraft Rocket Fuzes

- -

Final Report

on

Functioning Test of P.D. Rocket Fuze T-2025

Project No.: Chief of Ordnance TA1-2704 Date:
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TABLE I

FUNCTIONING TEST OF POINT DETONATING FUZE T-2025

TABLE OF TEST RESULTS

Rd. No.	Fuze No.	Obliquity	Target Thickness	Target Material	Velocities ft/sec. Desired	Velocities ft/sec. Obtained	Propelled by (a) 5" Head Motor (b) 5" Pusher "	Head Loading	Time of Flight Sec.	Functioning	Explosive Delay
1	13	0°	0"500	24ST Alum.	2000	1862	(b) HVAR	Tetryl (Black)			
							(a) Model 38	(Powder)	-	HD	Not greater than 24 inches
2	18	0°	0"032	" "	"	2075	(a) Model 38				
							(b) HVAR	"	1.3	Dud	-
3	16	0°	0"064	" "	"	2169	(a) Model 38	"	0.99	Dud	-
4	12	0°	0"125	" "	"	est. 2200	(a) Model 38	HE	0.95	Dud	-
5	7	0°	0"250	" "	"	est. 1800	(a) HVAR	HE	1.2	High Order	Less than 6 inches
6	9	0°	0"250	" "	"	1487	(a) HVAR	HE	1.5	Dud	-
7	3	0°	0"250	" "	"	1801	(a) HVAR	HE	1.12	Dud	-
8	11	0°	0"50	" "	"	1822	(a) HVAR	HE	-	Dud	-
9	6	0°	0"50	" "	"	1738	(a) HVAR	HE	1.14	High Order	Less than 6 inches
10	10	0°	0"50	" "	"	est. 1900	(a) HVAR	HE	1.3	Dud	-
11	19	45°	0"064	" "	"	1976	(a) HVAR	HE	.99	Dud	-

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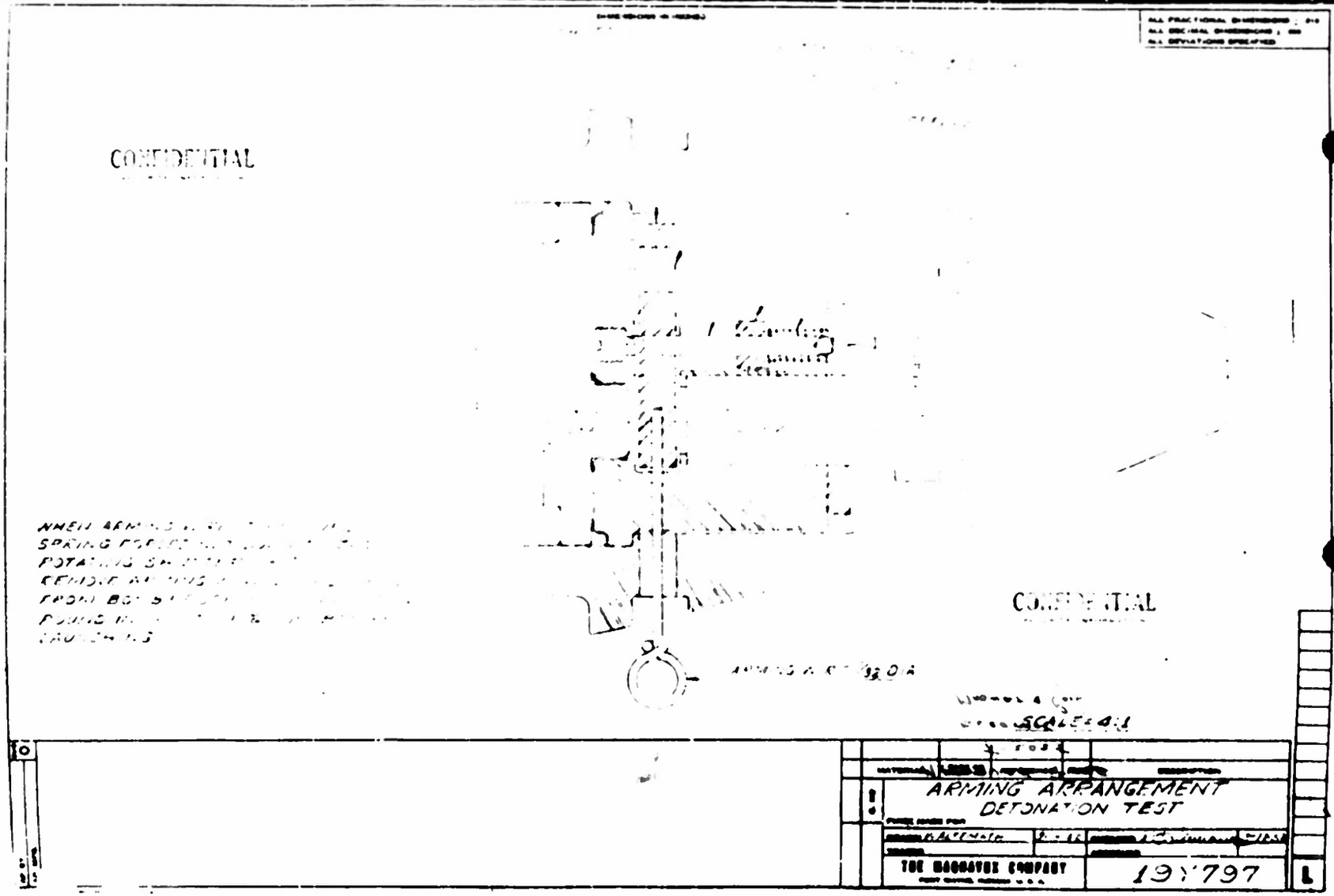
Functioning Test of Point Detonating Fuze T-2025 Photograph of Magnavox Drawing No. 19Y695.
Figure 1

Functioning Test of Point Detonating Fuze T2025 Photograph of Magnavox Company Drawing No. 19Y797.
Figure 2



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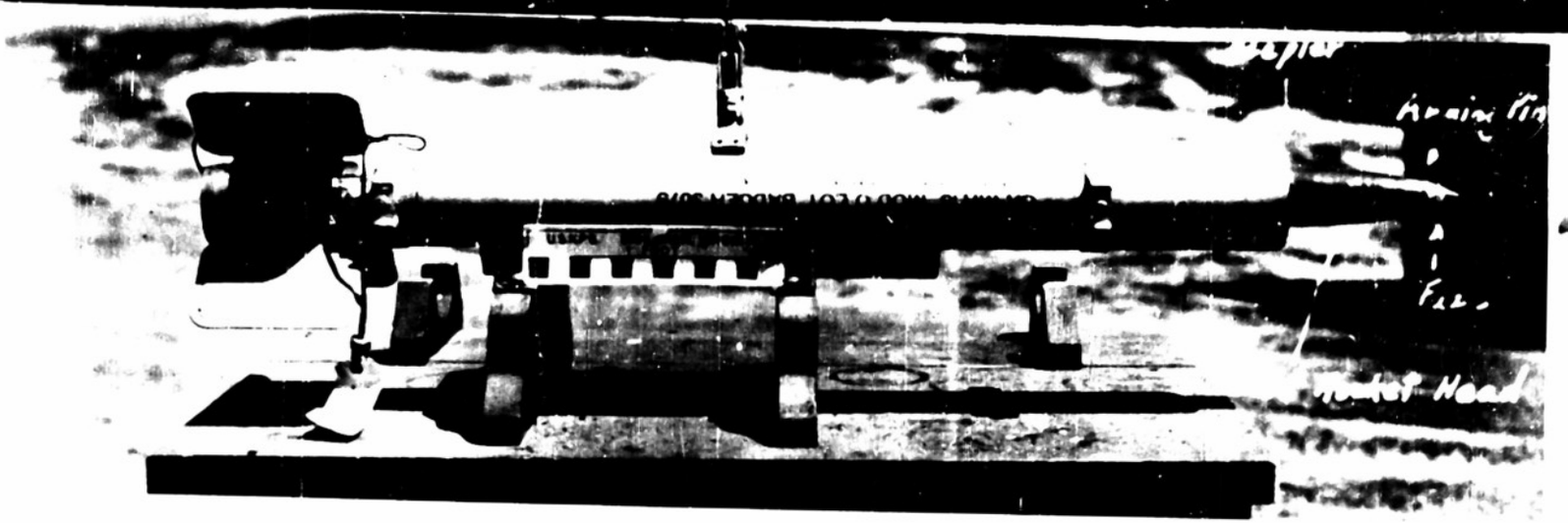
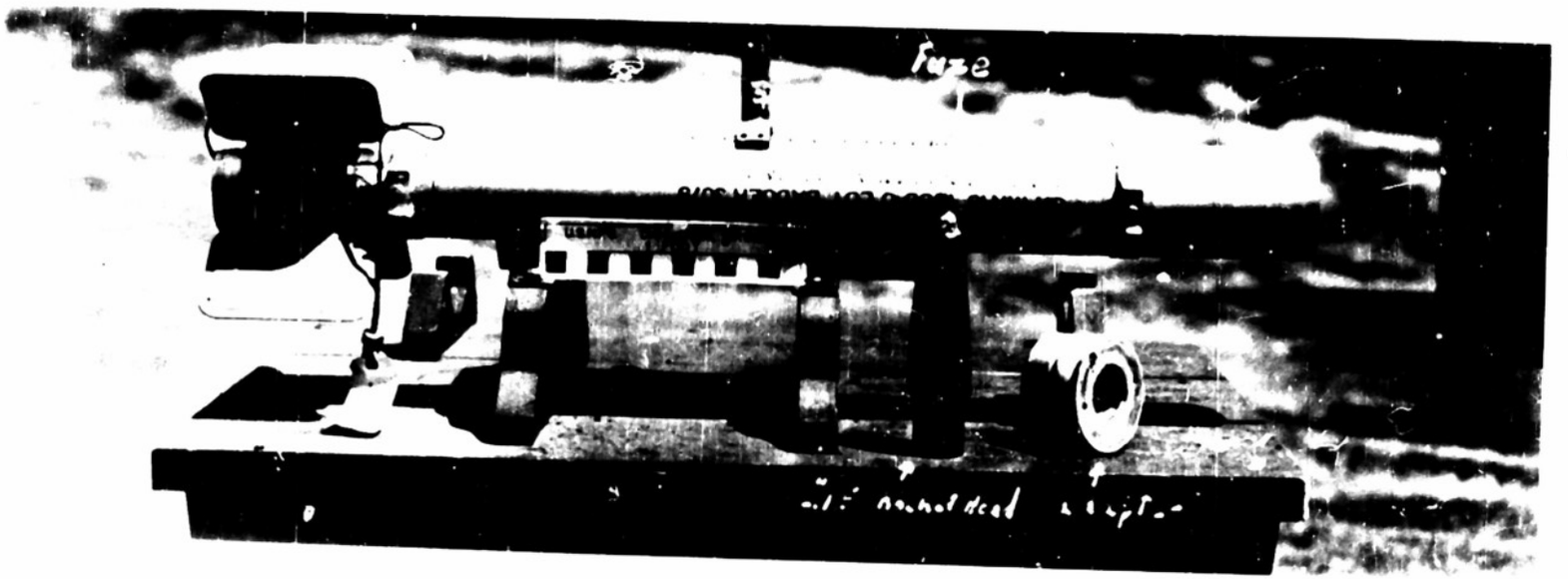
Functioning Test of Point Detonating Fuze T2025 Photograph of Experimental round before and after assembly.

Figure 3





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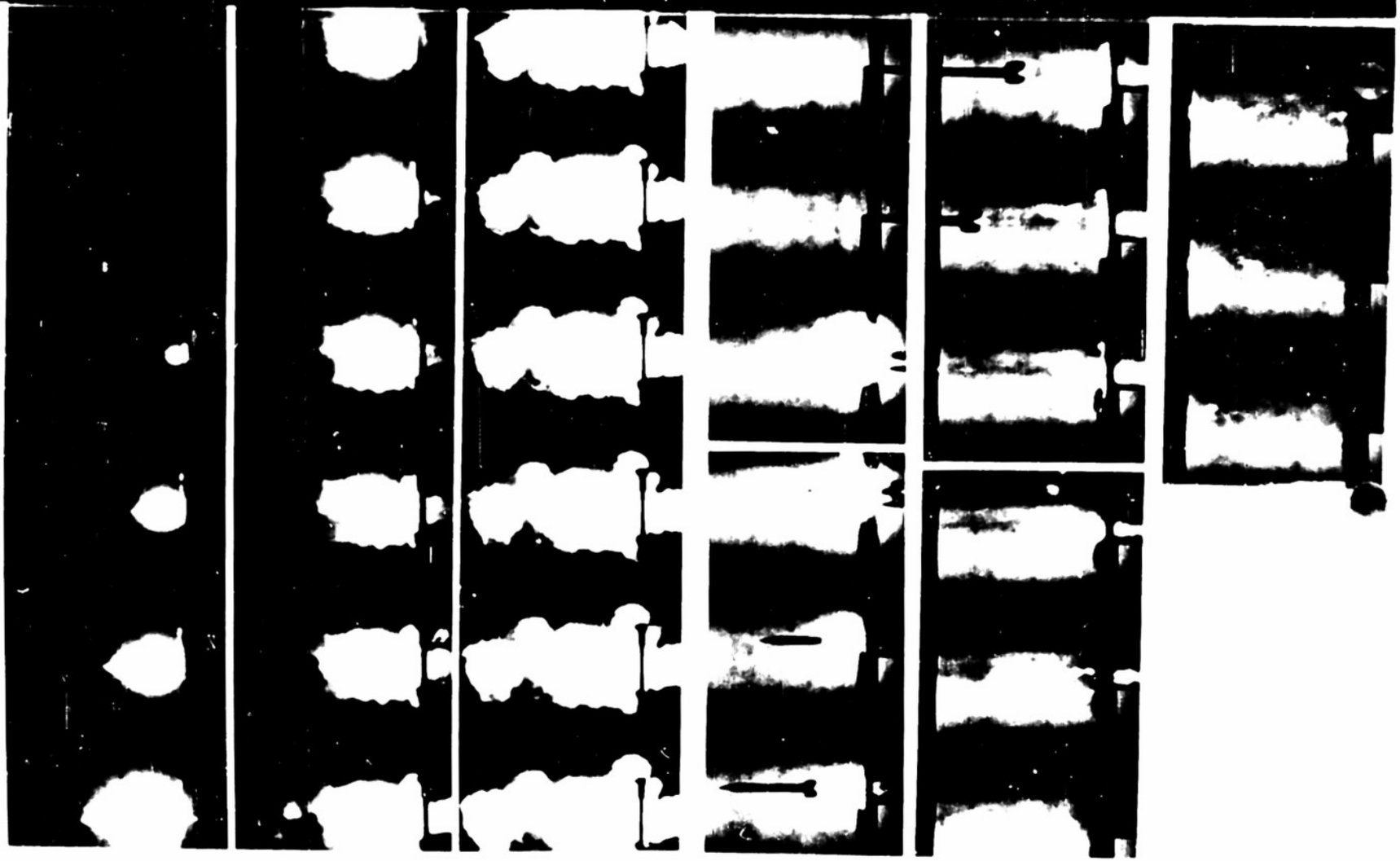
Functioning Test of Point Detonating Fuze T-2025. View of target during rocket penetration. Camera 16mm Eastman - frame rate est 3000 fps. Fired from 1050 ft. launcher. 2.75 Rocket Head (Smoke Puff Loaded).

Fig. No.	Rd. No.	Target	Obl.	Striking Velocity	Func.	Remarks
4	1	0.500 24ST Alum.	0°	1862 ft/sec	HO	Explosive delay less than 2 ft.
5	2	0.032 " "	0°	2075 "	Dud	Note: (1) Plate flash (2) Intact condition of head after penetration.

Figure 4

Figure 5



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Functioning Test of Point Detonating Fuze T-2025. View of target during rocket penetration. Camera 16mm Eastman - frame rate est 3000 fps. Fired from 1050 ft. launcher in 2.75 Rocket Head. Rd. 3 Smoke Puff Loaded. Rd. 5 High Explosive Loaded.

Fig. No.	Rd. No.	Target	Obl.	Striking Velocity	Func.	Remarks
6	3	0.064 24ST Alum.	0°	2169 ft/sec	Dud	Plate flash, no head detonation.
7	5	0.25 24ST Alum.	0°	1800 ft/sec	HO	Delay in functioning less than 6".

Figure 6

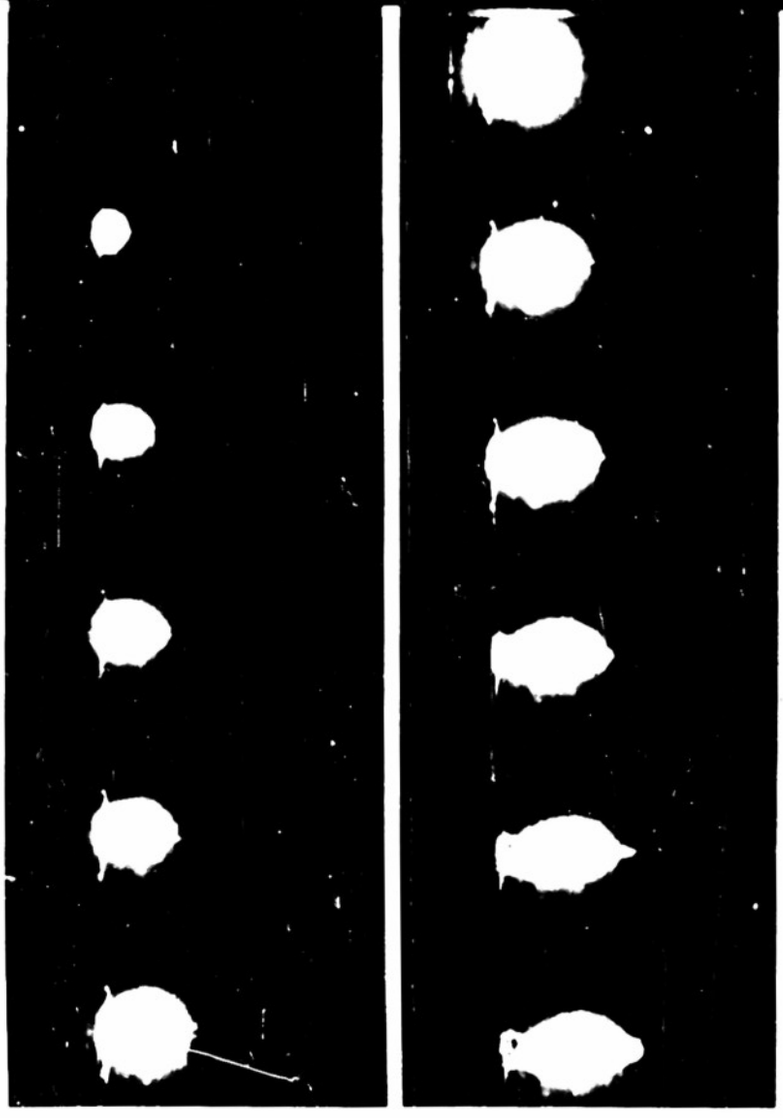

Figure 7

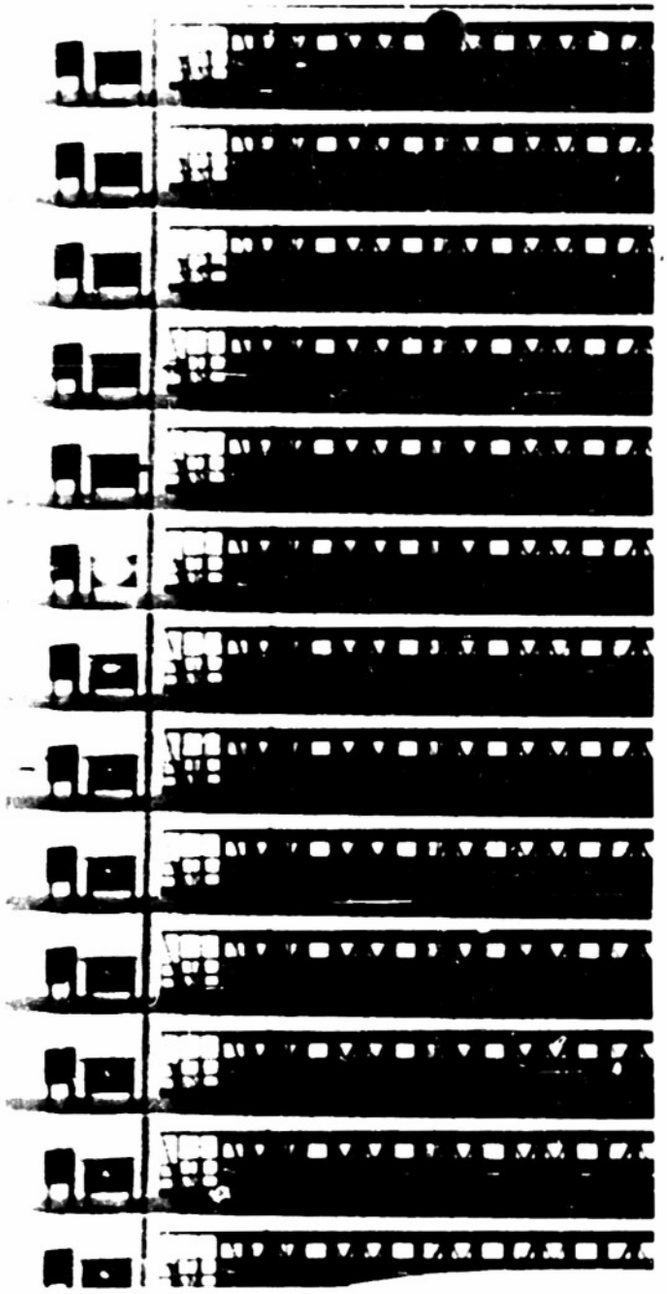

Figure 8

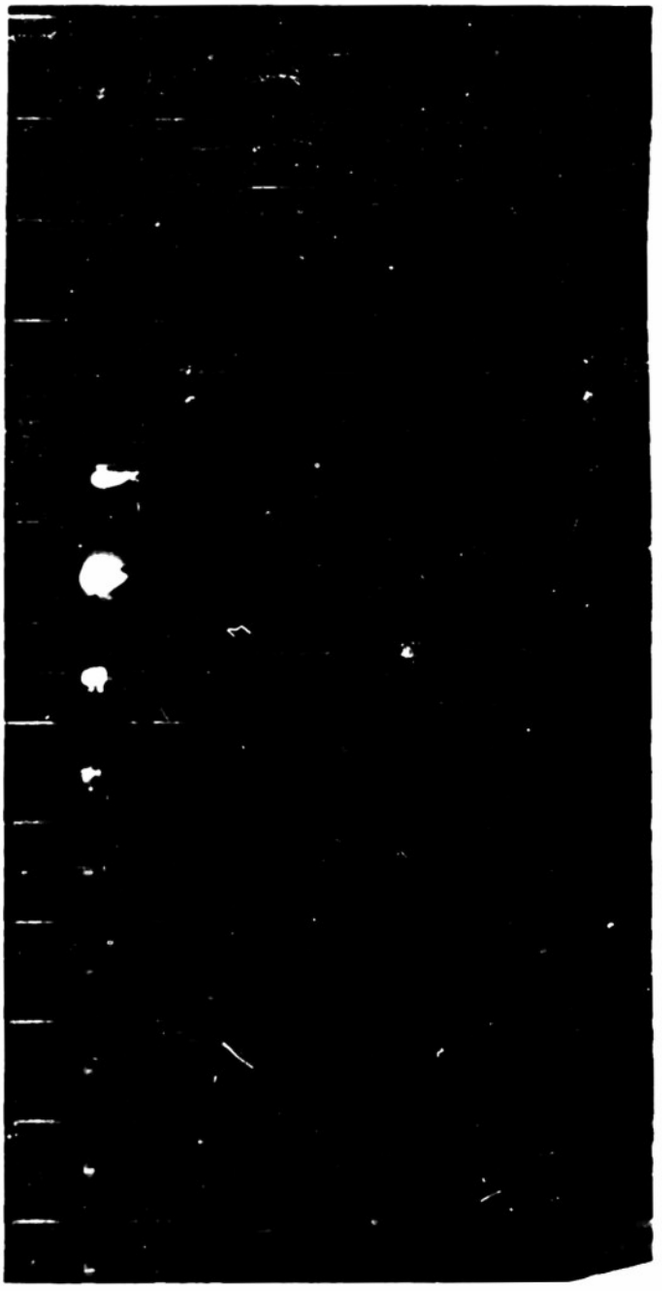

Figure 9

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Functioning Test of Point Detonating Fuze T-2025. View of target during rocket penetration. Camera Bowen - frame rate 90 fps.

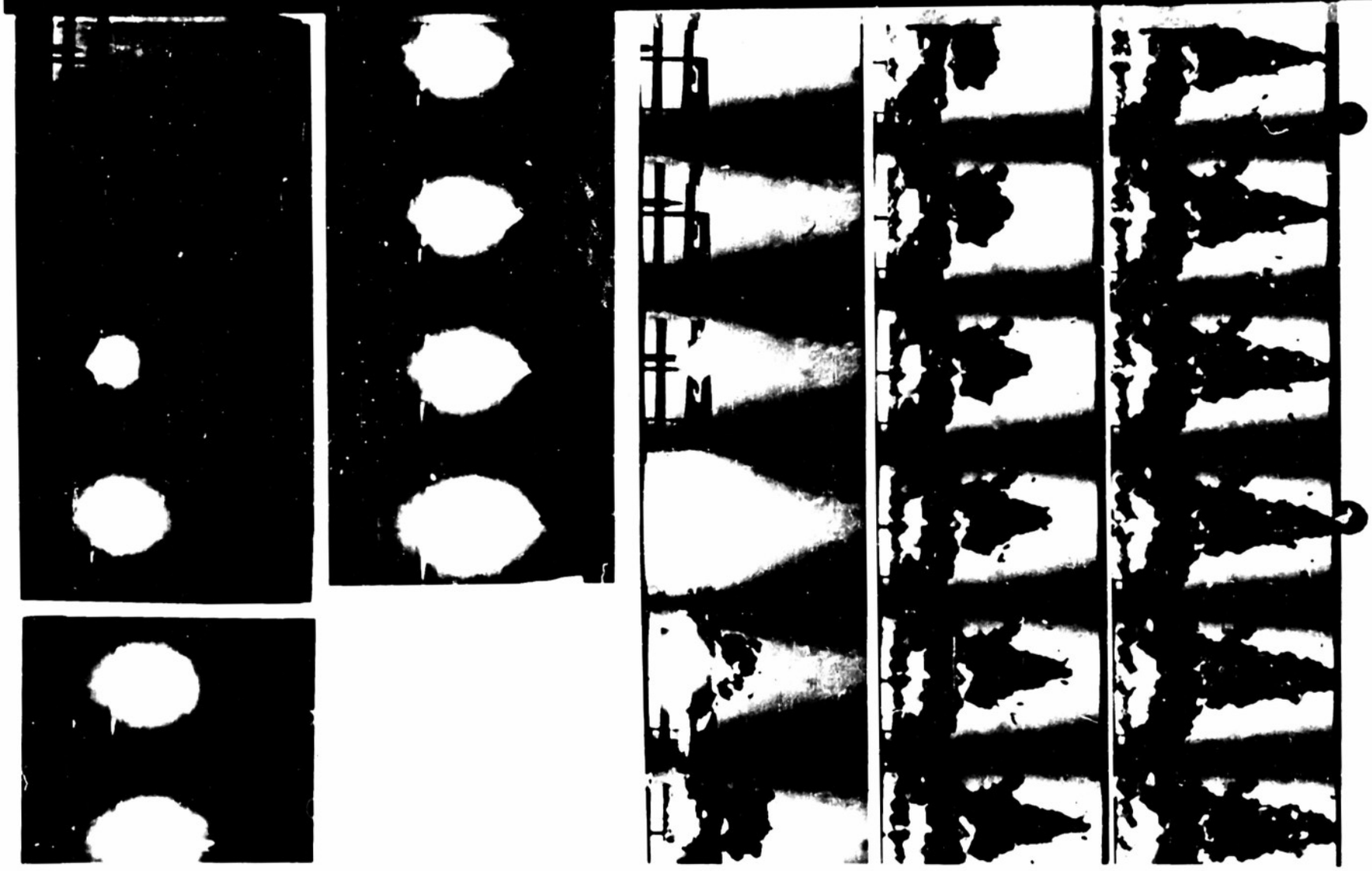
Fig. No.	Rd. No.	Target Thickness	Obl.	Striking Velocity	Func.	Remarks
8	2	0.25 24ST Alum.	0°	1487	Dud	Plate flash is seen and not head detonation

Functioning Test of Point Detonating Fuze T-2025. View of target during rocket penetration.

Fig. No.	Rd. No.	Target	Obl.	Striking Velocity	Func.	Remarks
10	8	0".50 24ST Alum.	0°	1324 ft/sec	Dud	Plate flash is seen and not head detonation.
11	9	0".50 24ST Alum.	0°	1738 ft/sec	NO	Note: (1) Explosive delay estimated at less than 6". (2) Note plate fragments.

Figure 10

Figure 11



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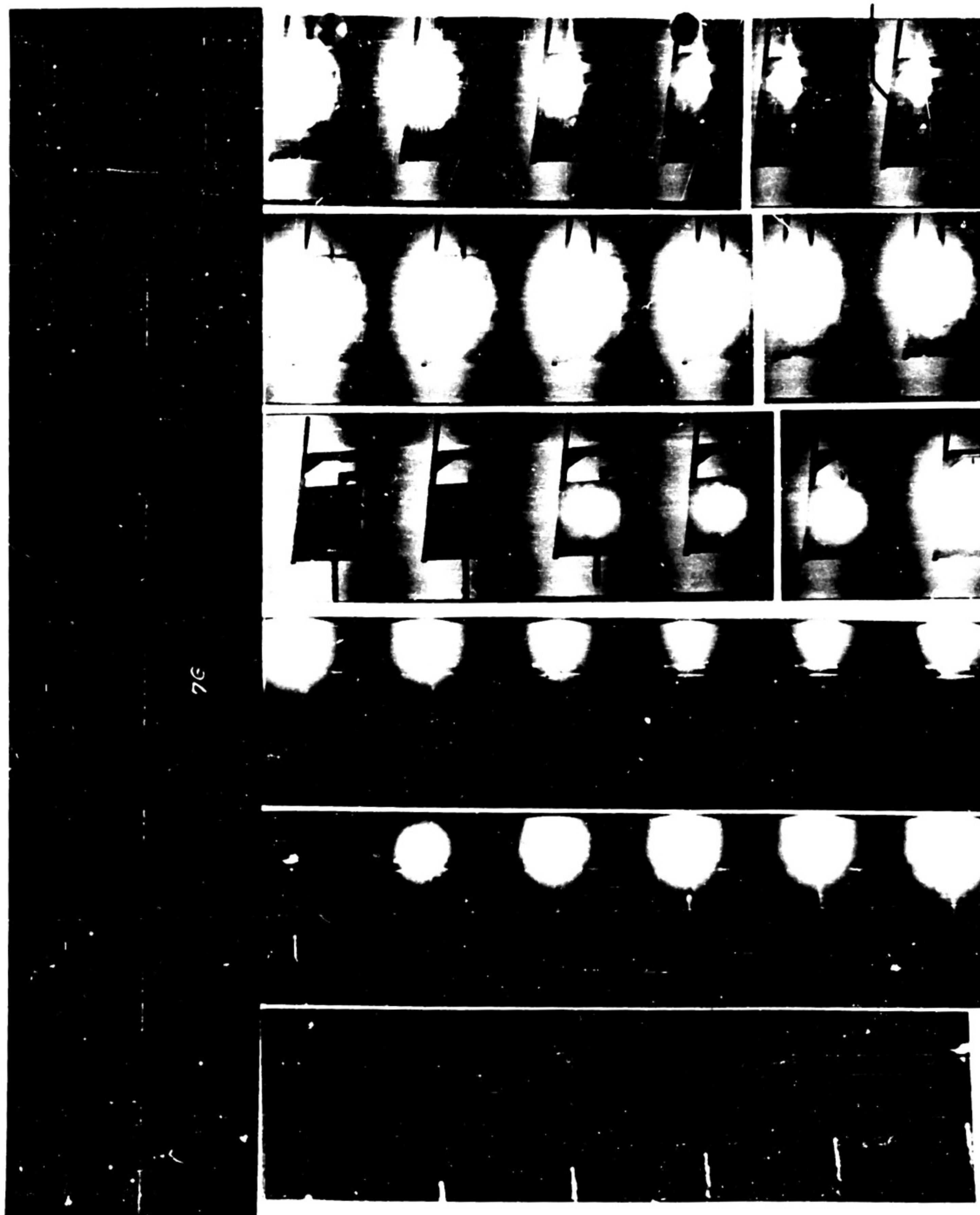
NP9-49339
Functioning Test of Point Detonating Fuze T-2025 on face of 1/2" 24ST Aluminium Plate. Photo graph of 1/2" (24ST Aluminium Target) showing Impact of round 9 with High Order detonation marks on the face of the target. Striking Velocity 1738 ft/sec. Target was set normal to the line of fire.

Figure 12



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Functioning Test of Point Detonating Fuze T-2025. Photograph of recovered dud.

Rd. No.	Fuze No.	Date Fired	Obl.	Striking Velocity	Target	Function
10	10	4-18-52	0°	est 1700	1/2" (24ST Alum.)	Dud

Note: (1) Base torn off.
(2) Point of fuze punctured.

Figure 15

Functioning Test of P.D. Rocket Fuze T-2025

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